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भारतीय मानक

सार्वजनिक पता तंत्रों के बाहरी संस्थापन — रीति संहिता

(पहला पुनरीक्षण)

Indian Standard

OUTDOOR INSTALLATION OF PUBLIC ADDRESS SYSTEM — CODE OF PRACTICE

(First Revision)

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BUREAU OF INDIAN STANDARDS
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Acoustics Sectional Committee, LTD 5

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Acoustics Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

This Indian Standard was first issued in 1961. The revision has been taken up to bring it in line with the latest developments in the field of public address systems.

The installation and use for amplifying systems of Public and Private functions has been greatly on the increase in the past few years. While in some instances such installations are done by professional engineers more often than not installation by non-professional people show inadequate attention to essential details and under such circumstances, even the best pieces of Public Address equipment do not give their optimum performance. This Code has been prepared with a view to acting as a guide for outdoor installation, permanent as well as temporary taking into consideration the practical limitations and requirements which are normally met with.

As the performance of a Public Address System has essentially to be judged finally by subjective means it becomes very essential to choose the right type of equipment and make a thorough study of the surroundings, type of audience to be covered etc, in order to drive the greatest advantage from the system. It is therefore, recommended that whoever has the responsibility for large scale installation should seek the advice of a competent and qualified audio engineer. Such an engineer should be able to assist in preparing an initial statement of the exact requirements of equipment to meet a particular situation and later on confirm that the installation offered is likely to meet the needs of such a situation.

This Code covers the preliminary steps to be taken, design consideration, choice of equipment and installation practices including installation of column loudspeakers. Since most of public address installations work from electric main supply, the need for safety precautions is obvious. Consideration has, therefore, been given in this Code to the best practices of earthing and other steps to prevent electrical shocks from accidential contact.

Unless specified otherwise, the requirement or characteristics of amplifier, specified in this standard are based on the method of measurement specified in latest Indian Standards for Method of Measurement in Audio Amplifiers.

Installation of indoor public address systems, though having many features in common with outdoor systems, varies from the latter mainly for reason that architectural patterns of the hall or enclosure concerned play a large part in the choice and design of equipment and the manner in installing them. Such installations are covered in another Indian Standard Code of Practice for Installation of Indoor Amplifiers and Sound Distribution Systems.

Wherever a reference to any Indian Standard appears in this Code, it shall be taken as a reference to the latest version of the standards.

All quantities and dimensions appearing in this standard have been given in metric system.

This Code is included chiefly to recommend the requirements of design and quality of equipment and the method of installation of outdoor public address amplifying and sound distribution system and it does not include all the necessary provisions of a contract.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

OUTDOOR INSTALLATION OF PUBLIC ADDRESS SYSTEM — CODE OF PRACTICE

(First Revision)

1 SCOPE

1.1 This code of practice, dealing with the installation of public address systems in open spaces in places which may be adjacent to permanent buildings or temporary structures, seeks to establish a standard practice for such installations and a proper set of criteria for good and reliable performance ensuring desired quality of reproduction from the system as a whole in the area covered.

This Code applies to temporary and permanent outdoor installations.

1.2 This Code has been prepared with a view to covering the needs of tropical climates in particular.

2 TERMINOLOGY

2.0 For the purpose of this Code, the following explanation of terms shall apply.

2.1 Matching

One part of a circuit is said to be matched to another part when they are so designed as to give satisfactory operation when connected together. It does not necessarily imply maximum power transfer between units.

2.2 Controls

2.2.1 *Manually-Operated Controls*

These are operated manually for varying some performance characteristic of the equipment, such as volume or tone. These controls may require adjustment during the normal functioning of the installation.

2.2.2 *Present Controls*

These are devices which vary some characteristics, such as volume tone or negative feed back of the equipment. Such controls are preset, while setting up the equipment and testing the installation. They are normally inaccessible and are not required to be used during the operation.

2.3 Shielded Wiring

Wiring in which the conductor or conductors and their insulation are enclosed in an earthed and continuously low resistance conducting sheath for example, metal sheathed cable or metal braided cable.

2.4 Standby Equipment

Equipment which is wired and kept ready for immediate substitution in case the main equipment fails in operation. Special switching circuits are used for such substitution.

2.5 Monitoring Equipment

Equipment, such as output level indicator, loud speaker or headphone connected to the output line of any stage of the Public Address System and used by the operator to assess the level and quality of the outgoing signal.

2.6 amplifying System

That part of the installation comprising of preamplifiers, mixers, equalizers and power amplifier.

2.7 Pre-amplifiers

The part of the amplifying system, essentially a voltage amplifier, suitable for operation with input source such as from microphone, tape player etc. The output from such an amplifier is connected to a mixer or another amplifier operating at a higher input level.

2.8 Mixer

A mixer is a device used to mix two or more input signals from microphones as well from input sources like cassette tape players, electronic organ etc. The mixer also has inbuilt pre-amplifier so that mixer can be connected to another amplifier operating at higher input level.

2.9 Equalizer

An equalizer is a circuit to perform Equalization which is a technique employed in transmitting, recording or amplifying program material by which selected frequencies are compensated in order to obtain a desired overall frequency response. The Equalizer is also applied for matching of sound systems to room acoustics by the use of filters.

2.10 Power Amplifier

The part of the amplifying system intended to amplify the signal derived from pre-amplifier, mixer, equalizer to a level capable to drive load, that is, loud speaker.

2.11 Patch Cord

A short piece of shielded cable for connecting the input and output circuits of the various items of equipment in the system, terminated at either end in suitable plug corresponding to the type of jacks used in the system.

2.12 Horn Speaker

Horn speaker employing compression driver and horn are suitable for outdoor application for programmes like public meeting for speeches, etc.

2.13 Column Speaker

A group of loudspeaker connected in phase of either direct radiator or compressor driver horn type mounted close to each other on a suitable fixture in linear fashion.

2.14 Loudspeaker Cluster

Combination if direct radiator type LF driver and HF driver (direct radiator or compression type) with frequency driver network are generally used for high quality outdoor installation.

3 PRELIMINARY STEPS

3.1 Exchange of Information

The initial and ultimate requirements of the installations should be ascertained as accurately as possible by prior consultation between the parties concerned. On the basis of this information, plans should be prepared showing:

a) details of the installation proposed,

b) the accommodation and the location of the central amplifier equipment, and

c) the ducts and overhead lines that may be required for the wiring.

3.2 Approval of Plans

Approval of plans for the proposed installation should be obtained from the authority concerned well in advance.

3.3 Power Supply (*see also* 7.5)

The local electricity authorities should be contacted for providing the electric power supply mains near the proposed location of the central equipment. The installation should be normally operated from 240 volts, single phase 50 Hz AC main supply and preferably capable of operation from 12-24 V storage battery.

3.4 Accommodation

The location of the central equipment, loudspeakers, microphones etc, should be agreed between the engineers and the authorities concerned and the accommodation reserved at an early stage.

3.5 Ducts and Overhead Lines

A cabling plan should be drawn up and agreed to in accordance with requirements both from the convenience and technical points of view. In case of lines which have to run outside the property concerned, the right of way should be obtained from the Posts and Telegraphs Department or these should be got laid by that Department. In any case, an agreement for the projection of the lines should be reached with appropriate authority such as Electricity Department, Posts and Telegraphs, Railways, etc, whenever necessary.

3.6 Circuit Plans and Operating Instructions

Complete block diagrams and schematic diagrams for the equipment installed should be prepared and made available along with the circuit diagrams for each of the equipment, at the place where the central equipment is located. The layout and sizes of the wiring and cabling should also be indicated. The loudspeaker load connected to each output line and the particulars of the line transformers should be indicated. The operating Instructions should also be made available which among others should indicate the rating of the fuses.

4 QUALITY OF MATERIAL AND COMPONENTS

4.1 Conformity of Specifications

All materials, equipment and other components of the installation should conform to the relevant Indian Standard specifications wherever they are applicable.

4.2 Socket Outlets and Plugs

The socket outlets and plugs used for the installation should not be interchangeable with those used for electric lights or other power circuits.

5 DESIGN CONSIDERATIONS

5.1 General

The output from the microphone, record player, compact disk player, tape recorder or radio tuner or the reproduction from sound film is amplified and presented to the audience in the area at the requisite volume level through the medium of loudspeakers installed at chosen locations. The design of the installation should be such that the sound reproduced through the system under ideal conditions should be the same in the quality as the original. In practice, however, the acoustic conditions determine the quality.

5.2 Quality of Reproduction

5.2.1 The sound reproduction resulting from outdoor public address systems may be classified as follows with reference to the quality of reproduction:

a) "A" category — desirable where high quality reproduction is aimed at (for example open air social functions, sports activities) and

b) "B" category — employed where the prime consideration is intelligibility (for example speeches).

5.2.2 "A" category system should be governed by the following requirements:

a) *Frequency response*

The frequency response of the system (excluding loudspeakers) shall be within + 3dB from 100 to 10 000 HZ.

b) *Harmonic distortion*

The total harmonic distortion of the system (excluding loudspeakers) shall not exceed 5·0 percent at the rated output of the amplifier.

c) *Signal-to-noise ratio*

The signal-to-noise ratio under operating conditions of the amplifier system as a whole with flat operation of the tone control shall not be worse than + 50 dB.

5.2.3 "B" Category system should have a useful frequency range from 150 to 8 000 with 5% distortion.

5.3 Acoustic Power Requirements

a) The distribution of sound should be uniform with maximum permissible variation of + 6dB.

b) The system should be capable to generate sound pressure level of at least 10 dB above average noise level encountered. In case of high ambient noise, it is not always possible nor recommended to generate sound pressure level of 10 dB above average noise level. In such cases special spectral shaping with selective compression is required.

6 CHOICE OF EQUIPMENT

6.1 General

Normally the installations comprise the following principal items of equipment:

a) Source of Input Signals — one or more microphones, cassette player or any other sound recording and reproducing equipment;

b) Amplifying Equipment System — one or more amplifiers; and

c) Loudspeakers.

6.2 Source of Input Signals

The input signals for operation of the installation are generally derived from one or other of devices mentioned **6.1** (a).

6.2.1 *Microphones*

a) *Moving Coil Microphone*

This is a robust and commonly used. These are normally available in low impedance outlet and should have unidirectional characteristics.

b) *Condenser Microphone*

Due to smaller size, condenser microphones are commonly use for lavallier application either as tie pin type or as neck type for associated electronic circuitary. These microphones have high sensitivity than moving coil microphones.

6.2.2 *Recording and Reproducing Equipment*

Cassette recorders/players provide good quality of sound recording and reproduction on PA system. There can be other good music sources also.

6.3 Amplifying System/Equipment

The rated output power of the amplifying equipment should be sufficient to work the loudspeaker load connected to the output line. The amplifier which may have a sensitivity sufficient to operate only from the highest input voltage likely to be met with, has to be supplemented with pre-amplifier for use with sources of lower voltage. Either integrated amplifier having facility for accepting input signal from various sources mentioned in **6.2** or a separate mixer and booster combination can be used.

6.3.1 The output transformers (*see* **6.5.2**) of the amplifiers should have impedance tappings of 4, 8 and 16 ohms to enable operation with loudspeakers of these standard impedances.

6.3.1.1 When specified, the transformer should be provided with 70 to 100 volts constant voltage tappings (*see* also **6.5.3**).

6.3.2 High power amplifiers should be capable to withstand short term overload etc. Also incorporate safeguards against excessive voltage or current rise in case of open circuit conditions or short circuit conditions respectively, in the output circuit.

6.4 Loudspeakers

The choice of loudspeakers and their correct location should recieve careful attention, as it is of vital importance for the success of the public address system.

6.4.1 *Direct Radiator Type*

Permanent magnet moving coil type loudspeakers are recommended for use in covered places. such as under shamianas, pavilions etc, adjoining the large audience sitting in the open. A larger baffle or cabinet will improve the low frequency output.

6.4.2 *Projector (or Horn) Type*

The efficiency of these loudspeakers is comparatively high. Due to physical limitation of the size of the opening at the mouth of horn, the lower limit of the frequency range of projector type of loudspeaker is 150 to 250 Hz LMT should have low frequency cut off to avoid damage of voice coil and diaphragm at lower frequencies. These loudspeakers are more commonly used for speech reproduction of outdoor installations or in areas with high ambient noise, such as station platforms streets etc, because of their directional properties and higher acoustical efficiency. These loudspeakers could be used singly or in groups for effective distribution of sound.

6.5 Loudspeaker-Line-Matching Transformers

6.5.1 Outdoor installations would normally consist of a large number of loudspeakers of different type, connected to the output of the amplifying system through loudspeaker-line-matching transformers.

6.5.2 These transformers should have at least the minimum frequency characteristic required of the public address system. The power handling capacity of the transformer used with a loudspeaker should not be less than the power to be absorbed by the speaker. These should have serveral taps on primary and/or secondary to give multiple turns ratio (*see* **6.3.1**)

6.5.3 These transformers enable the loudspeakers, though the selection of proper turns ratio, to take an input of pre-determined value of audio load from the amplifier, at the same time, care being taken not to overload the loudspeaker. Where the constant voltage output line from the amplifier (*see* **6.3.1.2**) is used, the total wattage of loudspeaker load should not exceed the rated power of the amplifier.

7 INSTALLATION PRACTICE

7.1 Assembly and Mounting of Amplifying Equipment

7.1.1 *General*

All equipment should be robustly made and designed for continuous operation. Equipment should be securely installed in such a manner as to have convenient access to all sides of it. Access by unauthorised persons should be guarded against. Precautions should be taken to keep away dust from the equipment, especially if earth moving machines, concrete mixers etc, are working in the immediate vicinity of the accomodation provided.

7.1.2 *Controls*

All preset controls should be mounted behind cover plates and desined for adjustment only by use of a tool, such as a screw driver. The use of manual controls should be restricted to as few as necessary. All controls should have adequately low mechanical and electrical noise.

7.1.3 *Mounting*

7.1.3.1 When the number of equipment is not large, they may be placed on a table and wired. The positioning of the equipment should be such that the lengths of the interconnecting cables are kept minimum for convenience.

7.1.3.2 *Rack mounting*

In case the number of equipment is large, it is desirable to mount them in racks of suitable dimensions. The racks may be of metal of wood and either in one piece having compartments or different sections of uniform width assembled together. Each compartment or section shall contain one item of equipment. The height of the rack will depend on the number of equipment to be mounted and accomodation available, insuring that all manual controls are within easy reach. Switches should be provided for isolating any faulty section of the equipment thereby facilitating operation and avoiding danger to the operating personnel. The arrangements made should enable the remaining part of the equipment to be available for use. The patch cords if used should be tested and neatly arranged to avoid obstruction and should be easily identifiable. Necessary safety measure should be adopted to avoid accidental contacts with high voltage points in the rack.

7.2 Microphone Installation

7.2.1 Microphones should be so mounted as to minimize acoustic feedback. The microphone stands may be of the floor, table or desk type, capable of adjustment so that the height and direction of the microphone can be adjusted to suit the speaker. The microphone plugs and sockets should be preferably multi contact type freely interchangeable.

7.2.2 The correct distance between the microphone and source should be predetermined and arrange to be constant as far as possible. It is important to see that if the level of reverberant sound or surrounding noise near the microphone is high, the distance between the microphone and the source of sound should be reduced. The sound source should be directed towards the microphone as otherwise the high notes which are highly directional, would not be satisfactorily picked up by the microphone and thereby the clarity of the speech sounds reproduced by the public address system will be poor.

7.2.3 Microphone should be low impedance type which permit the use of long microphone cables without any loss of high frequencies.

7.2.4 When more than one microphone is employed, the output from several microphones should be mixed in a mixer and the common output fed to the amplifiers. Where the amplifier itself is capable of mixing the individual microphone inputs, separate mixer is not required.

7.3 Loudspeaker Installation

7.3.1 *Location of Loudspeakers*

The number, types and location of loudspeakers required to be installed to cover an entire outdoor meeting at the required volume level, have to be decided with reference to the following points:

a) The area to be served.

b) The position of the rostrum in the ground and the layout of the ground in front.

c) Direction and velocity of the wind.

d) The existence of large buildings or trees at the boundary of the ground which may give rise to echoes by reflecting the sound.

e) Ambient noise level at different places in the ground and at the rostrum.

7.3.1.1 *Size of the ground*

The size of the ground will give a basic idea of the size of the audience and the acoustic power requirements of the installation. For the purpose of estimation about 200 to 250 persons may be taken to be present per 100 m^2 of area. Depending on the ambient noise and electrical power input of adequate wattage into the loudspeakers may be required for satisfactory results.

7.3.1.2 *Position of rostrum*

The direction of sound radiated from the loudspeakeps should be away from the rostrum and not towards it, to avoid acoustical feedback into the microphones on the rostrum. It is important that at the microphone, the level of reverberant or reflected sound from the loudspeakers at the microphone is at least 15dB below the level of sound source, so that the full gain of the amplifiers could be utilised. It is desirable not to install high power loudspeakers close to rostrum. Even the projector type of loudspeaker has sufficient amount of back radiation and if installed near the rostrum would give rise to acoustic feedback.

It is also necessary that the loudspeakers near the rostrum are not installed at the same height as the microphones on the rostrum and no loudspeaker should be installed within a height of 4.5 m from the ground.

7.3.2 *Wind and Weather Shields*

The speed and direction of the wind over the ground during the duration of the function, control the distribution of sound over the ground. A cross wind of 15 to 20 km/h speed is sufficient to deflect the sound up to 10 to 15 degrees from the normal. It may be desirable to provide the microphone with wind shield protection against the wind shield. However, such a shield should be acoustically transparent and not to affect the performance of microphones. A brief note on the causes of wind noise and suitable wind and weather shields is given in Annex A for general guidance.

7.3.3 *Echoes*

The echoes from large buildings or trees at the periphery of the ground cannot be avoided altogether. The intensity of the echoes could be reduced by raising the height of the loudspeakers and directing the ground, as far as possible.

7.3.4 *Noise Level in the Ground*

It is general experience that the noise level in the audience increases fairly in proportion to the distance from the rostrum under normal conditions. Sometimes vehicular traffic of some proportion continues to ply on the roads crossing the rear or sides of the ground giving rise to considerable noise. The number of loudspeakers, their location, height direction and the power.

7.3.5 *Height and Inclination of Loudspeakers*

The height and inclination of loudspeakers shall be so adjusted as to give maximum satisfactory coverage.

7.3.6 *Grouping of Loudspeakers*

When in large installation of 100 V Line Matching as used the loudspeakers installed should be grouped into sufficient number of convenient lots depending on the areas to be served, such as indoor speakers, left wind, right wing etc. All the loudspeakers in each group should be connected in parallel and in phase across the output line. The pair of wires from each group should be terminated in change over switches of rubbing contact type at the amplifier end, so that the line could be isolated from the output of the amplifier in case of any line fault, or changed over and connected across the output line of a stand-by amplifier when it is provided.

7.3.7 In case of constant voltage systems, the total load connected should be such that the rated power of the amplifiers is not exceeded.

7.3.8 *Mounting of Line Matching Transformer*

The line matching transformers should be mounted in weather proof junction boxes of outdoor installations when used along with the projector type loudspeakers. In case, a board with screw type terminals may be provided for the changing of the tranformer tap quickly.

7.3.9 *Multiple Sounds and Their Avoidance*

In a large open ground, when the amplified sound is reproduced simultaneously from several loudspeakers, distributed over the ground the intelligibility of the received sound is impaired in certain areas in the ground due to the fact of comparable intensity in sound being heard from the different loudspeakers with noticeable time lag.

7.3.9.1 However, this difficulty of distortion due to multiple signals could be reduced for eliminated by introducing delay, so that the sound emerges from each of the remote loudspeakers at approximately the same instant as that at which the sound from the loudspeakers near the source, reaches the remote listener. For each 15 m distance between the source and a loudspeaker, it will be necessary to introduce a delay of approximately 0.0-45 seconds.

The delay could be introduced through either a digital tune delay unit or in certain cases central cluster of high power loudspeaker may solve the problem.

7.3.9.2 It should be possible to improve the intelligibility by proper spacing of the loudspeakers and progressively increasing the input power of the loudspeakers with the increasing distance from the rostrum.

7.3.10 *Column Loudspeakers*

If high power loudspeakers capable of delivering high wattage could be installed conveniently near the source, radiating the sound towards the audience, they would form virtually a single radiating source and distortion due to multiple signals in the ground would be avoided. Column loudspeakers are ideally suited for use in this manner. The advantage of this system is that a more uniform distribution of sound is made possible over the entire ground. If a vertical column is used, the sound is directed along horizontal plane, instead of being diffused equally in all directions. The fall of intensity of sound, the proportion to the distance from the line sources, is less than in the case of ordinary loudspeakers. The size and the number of the column loudspeakers installed and their direction depend on the audio power required to be radiated and its distribution in different directions from the rostrum.

7.3.10.1 The height and inclination should be suitably adjusted so that the audience close to the rostrum can avoid being directed in the high intensity field of the column. Acoustic feedback into the microphone may also thus be reduced and a larger area in front of the rostrum covered.

7.4 Wiring and Cabling

7.4.1 *Microphone and Other Input Sources cables*

These carry low level signals currents and are therefore susceptible for electrical interference. It is preferable to use twin core screened (copper braiding) microphone cable. The copper brading should be sheathed with an insulating covering. The microphone cables should be isolated from power, loudspeaker and telephone cables.

7.4.1.1 Joints in the cables should be avoided as far as possible. The plugs and sockets used for microphone cables should have strong self cleaning contacts so as to eliminate noise and they should be non-reversible and have a sufficient number of pins to connect not only the main conductors but also the cable shield.

7.4.1.2 Microphone cables should be laid without sharp bends as far as possible. Inside the building they may be laid on the floor along the walls or under the carpet to avoid damage due to heavy object falling on them and cutting them. When laid in the open, they should be either buried in the ground to a depth of not less than 20 cm or laid through an iron pipe buried in the ground to a depth of 15 cm if heavy pressure is expected due to movement of personnel over the surface. They may also be laid overhead at a height not less than 3·5 m from the ground, clipped securely to a bearer wire which may be galvanized iron of diameter 1·60 mm to 2·00 mm, the length depending on the span of suspension. Protection by conduit or capping should be provided wherever there is a risk of damage or interference with the wiring. Any wiring that is to be run below about 1·8 m in height along corridors or outside walls or on the floor should be protected likewise. The conduit should permit easy drawing in and out of the cables. The input and output cables of the amplifying equipment should not be run in the same conduit in which mains power supply cables are drawn.

7.4.2 *Loudspeaker Cables*

The cables chosen for loudspeaker connectors should be such that the line losses do not exceed the values specified in Table 1 in the case of direct connections. The size of the cable to suit the requirements of the situation may be made with the help of Table 1 (*see* P 9) as a guide.

7.4.3 *Wiring of the Equipment*

A schematic diagram of the equipment, switching arrangements, incoming and outgoing lines should be drawn before the equipment is assembled and wired.

The main and standby equipment (if any) is wired in accordance with the scheme. Patch cords if used for connecting the equipment should be carefully checked for faults before use.

7-4.3.1 A typical schematic diagram is illustrated in Fig. 1.

7.5 Power Supplies

7.5.1 *Mains Supply*

7.5.1.1 The equipment should normally operate from 240 volts single phase 50 Hz AC mains supply. If, however, the supply is different, for example 110 volts AC, a transformer of the required capacity and rating may be used.

7.5.1.2 Three phase mains-power supply may be used for deriving power to run the system, each phase being capable of delivering the total output necessary to operate the amplifying and the associated equipment. The equipment should be connected to one phase, the second phase being set apart for the load taken by the soldering iron, test gear, inspection lamps etc, and leaving the third as spare for use in an emergency.

7.5.1.3 A voltage regulating device will have to be provided if the regulation of the power supply is poorer than 5 percent.

7.5.1.4 The supply mains should be terminated in an iron clad switch with fuses of adequate capacity to meet the estimated load and provided with indicator lamps for each phase. Auxiliary switch board with 8 pin socket outlets and switch controls should be provided for connnecting the soldering iron, test gear, inspection lamps etc.

7.5.1.5 If non standard voltage or frequency is required to operate the equipment, a Invertor/ Convertor set of suitable rating will have to be used to obtain the required voltage and frequency.

7.5.1.6 When only DC supply is available a Invertor/Convertor of required capacity should be provided to convert the DC supply to AC.

7.5.2 *Absence of Mains Supply*

If no mains supply is available, petrol or diesel engine driven generating sets of the required capacity giving 240 volts, single phase, 50 Hz AC power supply should be used. Such a generating set should be located at sufficient distance from the rostrum preferably a large building sheilding it, so that its noise at the rostrum is not higher than what is present in the vicinity.

7.5.3 *Battery Supply*

In the case of a low power installations and when no mains supply is available, the amplifying system should be capable of operation directly from a storage battery.

7.5.4 All amplifier should preferably be capable to operate on 12 V/24 DC car battery besides on 240 V 50 Hz AC supply.

8 EARTHING AND OTHER SAFETY PRECAUTIONS

8.1 General

The layout and wiring of cables for loudspeakers shall, as far as possible, be so done as to ensure safety and avoidance of the installation. *The Indian Electricity Rules, 1956* and the Indian Standard Code of Practice for Electrical Wiring and Fittings in Buildings, should also be followed as far as they are applicable for wiring loudspeaker installation.

8.2 Earthing

8.2.1 Proper earthing of the entire installation with appropriate earthing of the individual equipment also is absolutely essential to avoid danger from any possible shocks to the users of the equipment, the operating personnel or the audience.

8.2.2 Earthing connections to the nearby water mains are of usually lower resistance than any form of buried earth-electrode system. An equipment or installation may be satisfactorily earthed by means of connection to the nearest water supply mains by a suitable water main the earthing may be done by connection to other efficiently earthed object by a good soldered joint or an earth clip.

8.2.3 The use of two or more separate earthing connections at different points on the system is inadvisable due to risk of trouble from circulating currents. While one end of the earthing wire or cable is connected to the water supply main or other earthed object, the other end shall be brought to a point on the installation to which point shall be connected all earthing leads from the various sections of installation as well as the binding wires from all incoming lead covered and screed cables excepting the microphone screening leads. The screening leads of a microphone should have a separate insulated lead run direct to the earth connection. It shall not be connected to the electrical earthing of the installation which gives rise to hum.

8.2.4 A fairly heavy cable (such as 7/0·75 mm VIR in conduit) or bare copper wire (of 4·0 mm dia) is normally satisfactory as the earthing connection lead. If bare copper wire is used, care should be taken to run it insulated from other metallic objects all along its length.

8.3 Safety Requirements of Amplifiers

The amplifiers or amplifier separating from Mains supply should conform to the requirements specified in IS : 9302 Operated Audio Amplifiers.

8.4 Fire and Explosion Risk

The Installation of the system in a situation, where there may be a possibility of an explosion, or in a flammable atmosphere, should as far as possible, be avoided. However, if becomes necessary to have the installations in such a situation it should not be vulnerable to fire explosion risks.

9 STANDBY EQUIPMENT

9.1 The installations may be roughly classified under three categories as follow:

a) The breakdown of the equipment should be resorted instantaneously setting aside the faulty equipment without waiting for servicing the faulty equipment.

b) The breakdown should be restored quickly, say within about 10 minutes by servicing the faulty equipment.

c) The breakdown of the equipment will not vitally affect the situation.

9.2 For the installation of category (a) at least hundred percent stand-by equipment will have to be provided so that all the working channels could be replaced, on failure, by a stand-by set of channels. The wiring of the input and output of the amplifiers is done in such a manner that the changeover from the main amplifier could be done by operating switches (*see* Fig. 1). After the changeover, the defective main amplifier could be serviced and kept ready for use again, if the meetings were to continue for sufficiently long time. Independent standby power supply unit, for example petrol or diesel engine driven AC generator of the required capacity giving 240 volts AC single phase, should be provided. Wherever conveniently possible a 12/24 volts storage battery operated amplifier complete with fully charged battery(ies) should be kept ready for switchover.

9.3 For installations of categories (b) and (c) sufficient care should be taken for easy accessibility of the lines, switches and equipment that are installed for quick location and servicing of the fault in the system.

10 INSPECTION, TESTING AND MONITORING

10.1 Inspection and Testing

The completed installation should be inspected and tested by the engineer to ensure that the work has been carried out in a satisfactory manner and that the materials and components used conform with the recommendation of this Code and that the plan and operating instructions called for in the respective clauses have been furnished.

10.2 Monitoring

For effectively controlling the working of the Public Address System, some form of monitoring equipment, such as an output level indicator or monitoring loudspeakers should be provided with their own volume controls and with provision for being switched over to other parts of the installation.

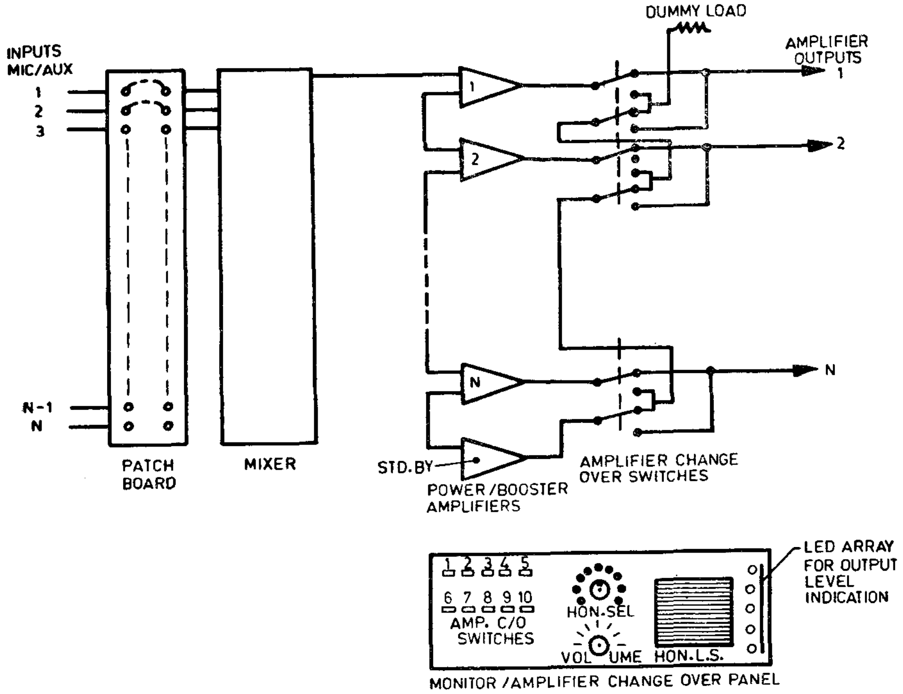


FIG. 1 TYPICAL OUTDOOR P.A. INSTALLATION

Table 1 Loudspeaker Cable Sizes and Lengths for Specified Line Losses

(*Clause* 7.4.2)

Low Impedance Line — 15 Percent Power Loss

Wire Size	**Maximum Length of Loudspeaker Cable for Load Impedance in Ohms**				
	2	4	8	16	32
mm	m	m	m	m	m
2·06	30	60	120	240	480
1·60	20	40	80	160	320
1·32	12·5	25	50	100	200
1·00	7·5	15	30	60	120
0·800	4·5	9	18	36	72

High Impedance Lines — 5 Percent Power Loss

Wire Size	**Maximum Length of Loudspeaker Cable for Load Impedance in Ohms**		
	100	250	500
mm	m	m	m
1·60	300	750	1 500
1·32	200	500	1 000
1·00	120	300	600
0·800	75	187·5	375
0·630	50	125	250

Maximum Length to Transmit Upper Frequency

Wire Size	**Maximum Length of Loudspeaker Cable for Upper Frequency Limit in c/s**			
	3 000	5 000	7 000	10 000
mm	m	m	m	m
2·65	1 500	1 150	900	820
2·06	1 200	950	750	600
1·60	900	730	600	520
1·32	750	580	460	410
1·00	600	460	380	320
0·800	—	380	300	260
0·630	—	—	—	200

ANNEX A

(*Clause* 7.3.2)

WIND SHIELDING AND WEATHER PROTECTION OF MICROPHONES

A-0 GENERAL

A-0.1 Microphones, used outdoors, may have to be fitted with some means of protection against wind and it is desirable that the performance and use of microphone should not be adversely affected by any such wind shield.

A-0.2 The clauses of wind noise may be considered as due to:

a) shock excitation of the diaphragm, owing to the fluctuating pressure wave-fronts of the wind; and

b) tones due to turbulence generated by flow of wind around the microphone as a whole, the frequency of these tones being in the region of 50-200 HZ for microphones of normal size.

A-0.3 These wind noises cause heavy low frequency rumbling sound together with high frequency impulsive noises and hissing sounds.

A-1 WIND SHIELD

A-1.1 An ideal wind shield is the one which offers high filtration loss to the substantially unidirectional air currents of the wind, while leaving audio frequency sounds relatively unaffected. This is normally achieved by a comparatively large shield, preferably spherical of about 225 to 250 mm in diameter, the outer surface being closely woven fabric, very fine wire meshes or porous materials possessing suitable characteristics. This type of shield may still give rise to turbulent noises which, of course are mainly confined to sub-audible frequency range due to the size of the wind shield. The overall subjective reduction in wind noise can be 20 dB or more.

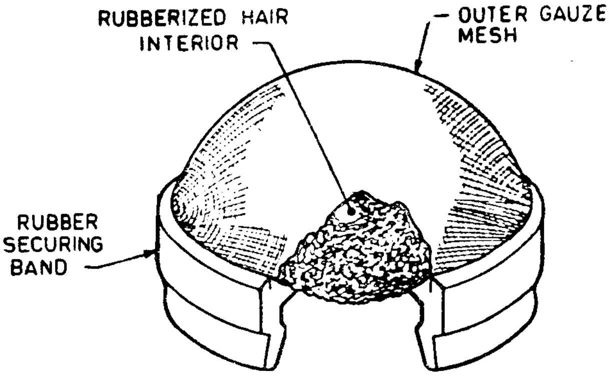
A-1.2 Large wind shield, as described **A-1.1** may not often be acceptable as they are very bulky to handle and obtrusive in appearance. A closely fitting wind shield of appropriate porous or foamed plastic material, which encloses the front or other opening of the microphone which is small in size and has a fair degree of immunity to the wind at the expense of a little loss in the extreme high-frequncy response may be effectively employed.

A-1.3 However, a wind shield of closely fitted type cannot greatly alter the wind — turbulence tones. A well designed shield of this type used in conjunction with some electrical has cut-off below 200 HZ, enables and overall attenuation of wind noise up to 20 dB to be achieved and allows good speech to be transmitted in strong winds of up to 65 km per hour. The effect on frequency response may be confined to a loss of 2 to 3 dB at 10 kc/S. Fig. 2 shows unobtrusive wind shields of this type.

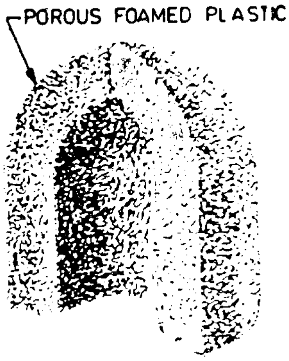
A-1.4 In the design of microphone itself a suitable amount of acoustic damping of the moving system and the case having the smoothness possible surface will help to reduce these disturbances.

A-2 WEATHER PROTECTION

A-2.1 Porous or foam materials usually require some protection in the form of an enclosing shield of fine woven wire mesh, which may be treated with the water repellent, such as silicon varnish in order to prevent the inner porous material from becoming sodden. If water is allowed to collect on these parts or on other parts involved in the acoustic transmission within the microphone a considerable loss of sensitivity particularly at the higher frequency is likely to occur.



2A Rubberized Hair Protected by Stainless Steel Woven Mesh



2B Silicon-Treated Foamed Plastic

FIG. 2 MICROPHONE WIND AND WEATHER SHIELDS

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